PRESCRIBED BURNING BLACKBRUSH FOR DEER HABITAT IMPROVEMENT

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ABSTRACT

Blackbrush is a monotypic shrub community endemic to enclosed basins in the Great Basin-Mojave Desert transition. It has poor to fair palatability and is deficient in phosphrous and protein during the winter period. Burning has been employed as a means of converting blackbrush to stands of more desirable forage species.

This preliminary report describes blackbrush response to wildfires and prescribed burning, the objective being to evaluate the use of fire to improve deer winter range in the Owens Valley. Studies of wildfires showed that fire increased plant species diversity and carrying capacities on most blackbrush sites. During the first years the burn site is dominated by annuals and shrub seedlings. Later successional communities are dependent upon site characteristics, such as soils and precipitation.

This study indicates that prescribed burning of blackbrush can improve deer habitat, but much more needs to be known of the ecology of this type before large-scale burning is undertaken.

INTRODUCTION

Blackbrush (Coleogyne ramosissima) dominates one of the least understood vegetation types in the western United States. This rosaceous shrub, with its unique floral characteristics of opposite leaves, lack of petals and four-merous sepals, is the sole species of its genus. It was first scientifically collected in 1854 by Col. John C. Fremont near the Mojave River, California, and is probably of more ancient origin than other of its desert shrub associates (Bowns and West 1976a). The shrub became known as "blackbrush" because of the dark gray color of its bark, which becomes black when wet.

Ranges dominated by blackbrush occur in a discontinuous band between the hot and cold deserts. The blackbrush type has mostly been interpreted as not belonging strictly to either the Mojave Desert or the Great Basin desert, but occupies an intermediate position between these two desert regions (Bowns and West 1976a).

Blackbrush ranges occupy about 11,440 km^2 (4420 mi^2) or 6.9 million ha. (17 million ac) in the western United States, principally along the Colorado and San Juan Rivers in southern Utah and adjacent parts of Arizona. There also are areas of blackbrush in southern Nevada, northeastern Arizona, southwestern Colorado and southeastern California.

Blackbrush generally forms a relatively simple community; monotypic communities are common and where shrub cover is high, blackbrush tends to form essentially pure stands that permit little growth of other vegetation (Bowns 1973). In fact, blackbrush so completely dominates available water at the site that no other vegetation can successfully invade it (White 1950). Solid stands of blackbrush may have resulted in areas where overgrazing has removed the perennial grasses and palatable shrubs (Bowns and West 1976b). Greater resistance to grazing probably allows blackbrush to persist and perhaps expand after the more palatable species are removed (Plummer et al. 1968).

Blackbrush is not preferred as forage by domestic livestock or deer. It provides poor forage during the spring, summer and fall for cattle, horses and sheep (Box et al. 1966) and carrying capacities are extremely low, varying from 30 to 300 acres per animal unit month. Blackbrush is low in phosphorus and protein in the winter grazing period (Table 1). The spinescent character of the shrub also adds to its low palatability.

Table 1. Nutrient content analysis of blackbrush leaves and stems. (Bowns and West 1976a).

Date	Phosphorous (%)		Crude Protein (%)	
	Leaves	Stems	Leaves	Stems
May	0.14	0.13	8.8	3.8
August	0.10	0.11	7.2	4.6
November	0.11	0.10	7.4	2.2
February	0.11	0.10	7.3	4.1
Mean	0.12	0.11	7.7	3.7

Cattle Requirement	Phosphorous (%)	Crude Protein (%)
Growth	0.18	7
Lactation	0.39	9

HISTORY OF FIRE IN THE BLACKBRUSH TYPE

Historically, prescribed burning has been used to convert blackbrush to better forage producing species; conversion results, however, have various successional communities; turpentine broom (Thamnosma montana), desert bitterbrush (Purshia glandulosa), desert almond (Prunus fasciculata), big sagebrush (Artemisia tridentata), and snakeweed (Xanthocephalum sarathrae) are common successors (Bowns and West 1976a). Large acreages of blackbrush also were removed through burning in Nevada, with cliffrose (Cowania mexicana), Nevada ephedra (Ephedra nevadensis), desert almond, snakeweed, and various desert shrubs commonly replacing the blackbrush (Jensen et al. 1960).

Though species composition varied following burning, conclusions can be drawn from these studies. Fire is an effective way to destroy blackbrush; blackbrush does not resprout and generally is extripated from the burned site for 25 to 30 years (Wright 1980). The initial plant community following blackbrush burning is composed of filaree (Erodium cicutarium), foxtail chess (Bromus rubens), and various annual species for 2 to 3 years (Bowns and West 1976a). Eventually perennial grasses and shrubs became established (10 to 15 years). Later communities vary and the successional path appears to be related to the potential of the site. Soil movement varies with site characteristics and weather conditions following burning. In some circumstances accelerated erosion was apparent, while in others, soil stability actually improved due to litter accumulation and increasing protective covering resulting after fire.

These studies point to considerable differences in site potential within the blackbrush type (Bowns and West 1976b). Blackbrush is thought to be a climatic climax, naturally dominating drier sites with residual or colluvial soils (Loope 1976), shallow soils with vescicular crusts (Thatcher 1976) or stoney soils (Beatley 1975). Blackbrush also invades desert grassland after grazing abuse (Wells 1961, Wells 1967). Therefore, site potential must be considered when contemplating blackbrush prescribed burning, proceeding with projects on those areas with better developed soils and potential to revegetate to more desirable plants.

Based on these past studies, there appears to be potential to improve areas with blackbrush by encouraging growth of a mixture of shrubs, grasses and forbs through prescribed burning. Burning was proposed for portions of blackbrush habitat on public lands in Owens Valley to "improve livestock forage and wildlife habitat" (USDI 1980). In 1982 an additional 300 acres of blackbrush shrub of the Buttermilk deer winter range was identified as an area desperately in need of management. A project was initiated to evaluate the use of fire for improving the deer winter range.

THE BUTTERMILK DEER WINTER RANGE

The Buttermilk winter range lies west of Bishop, California, between Pine Creek on the north and Bishop Creek on the south (Fig. 1). The range varies in elevation from 1370 to

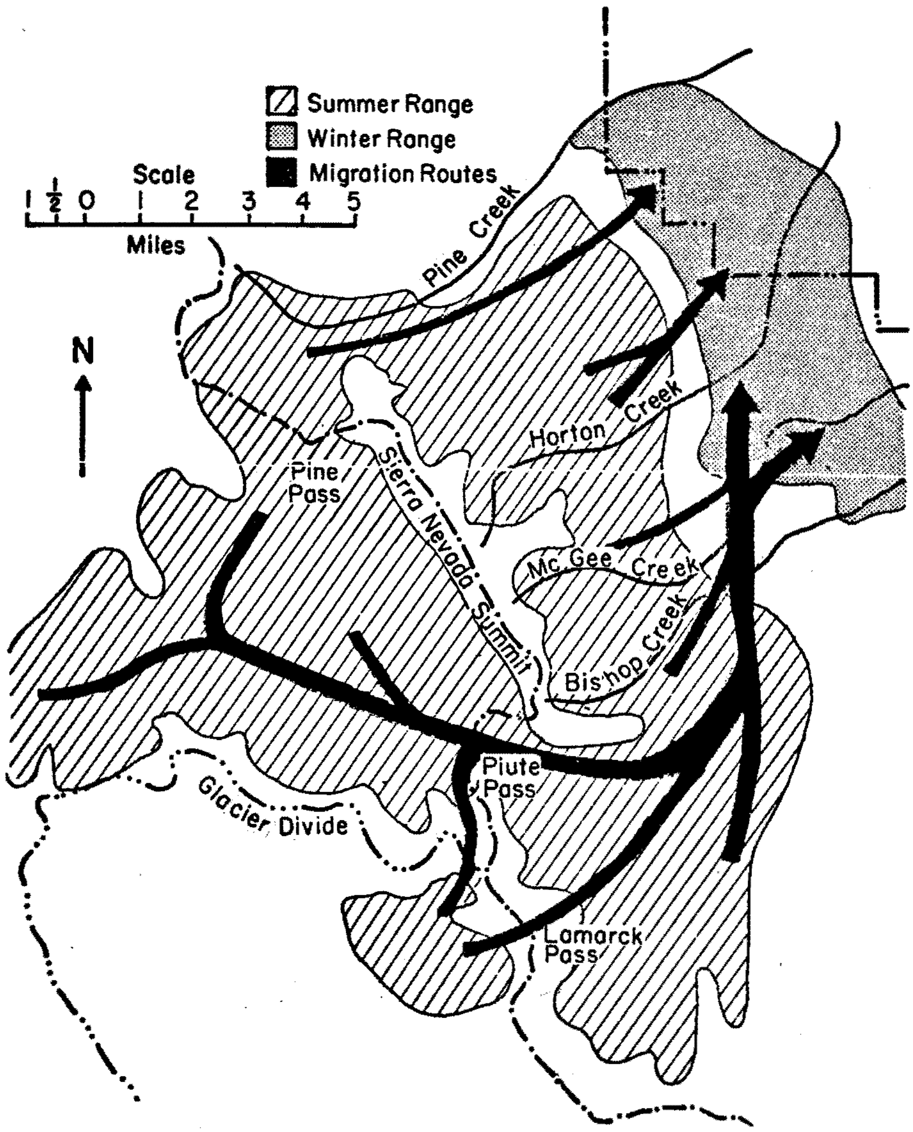

Figure 1. Buttermilk study area showing deer range and migration routes. Bishop, California is about 12 miles to the east.

2135 m. (4500 to 700 ft.) and averages 6480 ha (16,000 ac.) or 65 km^2 (25 mi^2). The range is composed predominantly of big sagebrush and antelope bitterbrush (Purshia tridentata) (Table 2); diets include mainly these species supplemented by a number of other browse plants when available (Fig. 2). Forbs and grasses are of little importance in the overall winter diet, because they are available only in spring (Leach 1956).

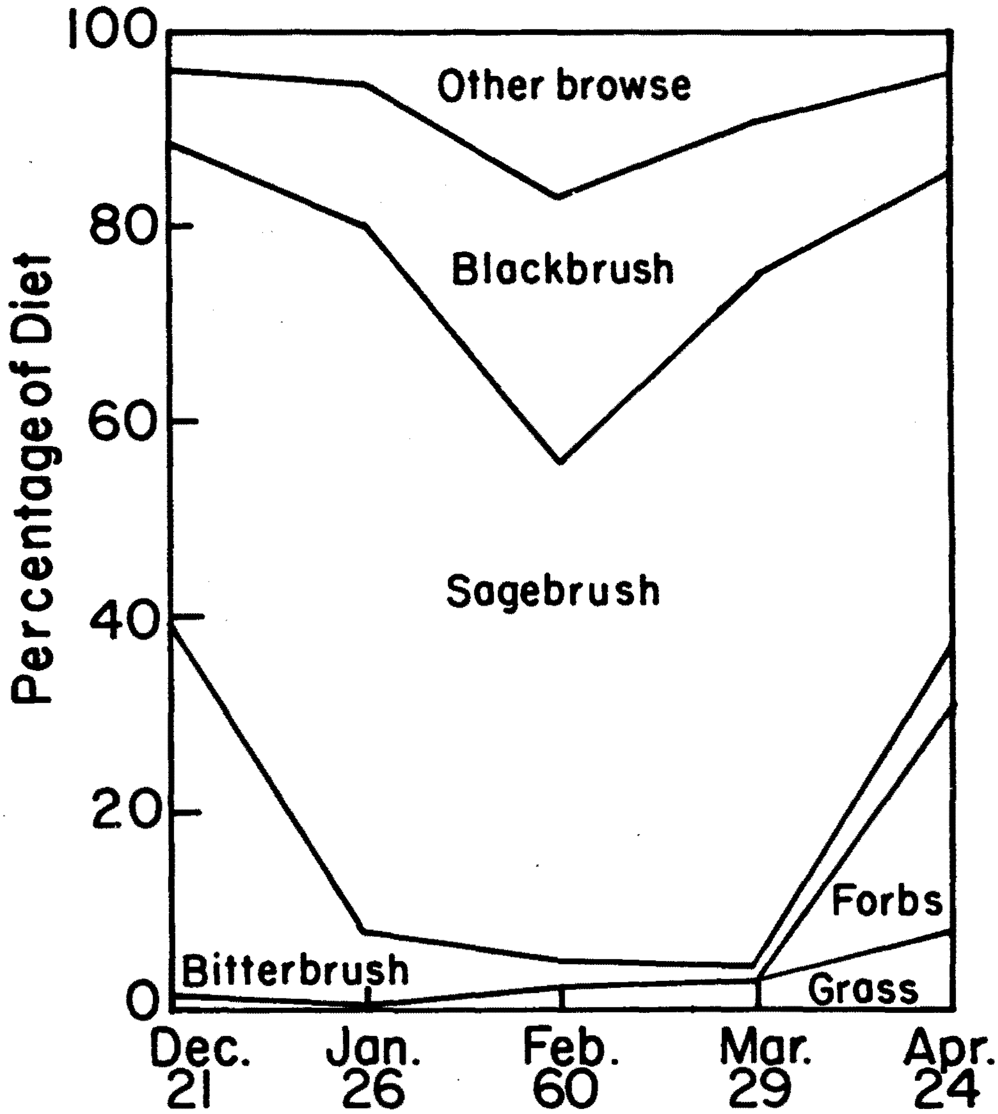

Figure 2. Winter food habits of deer on the Buttermilk winter range.

Table 2. Composition of vegetation on the Buttermilk deer winter range (Jones 1954).

	PERCENT
Grasses	
Annual grasses	0.6
Perennial grasses	7.2
	7.8
Forbs	
Annual forbs	5.3
Perennial forbs	1.3
	6.6
Browse	
Artemisia tridentata (big sagebrush)	29.4
Purshia tridentata (bitterbrush)	26.7
Coleogyne ramosissima (blackbrush)	12.5
Ephedra nevadenis (ephedra)	3.6
Eriogonum fasiculatum (buckwheat)	2.8
Other browse	10.6
	85.6
Ground covered by productive forage	30.0

In the northern and lower portions of the Buttermilk range, deer congregate on extensive open alluvial fans composed of 95% blackbrush cover. Browsing pressure on blackbrush is heavy. From rumen analysis blackbrush is second only to big sagebrush as winter diet of the deer (Table 3). Its highest contribution to the diet is in February, when it made up 27% of 73% of the stomach contents even though blackbrush is not considered a desirable deer forage species (Jones 1954).

Table 3. Volume percent of food items in deer stomach samples, Buttermilk winter range (Jones 1954).

	Oct-Nov %	Dec %	Jan %	Feb %	Mar %	Apr %
Grasses	41	trace	T	T	T	9
Forbs	9	-	T	-	T	26
Browse						
Big Sagebrush	7	50	70	46	83	48
Blackbrush	-	9	17	46	13	4
Bitterbrush	-	40	6	T	3	9
Misc. browse	21	1	7	6	1	4

Blackbrush has low protein value in mid-winter (Table 4). A low protein diet may be adequate during mild winter conditions; however, when weather conditions are severe more protein is required in the diet. Longhurst et al. (1976) found that the major factor causing deer mortality was inadequate nutrition. Problems of die off of the Buttermilk deer herd apparently center about shortages of nutritious forage (Bissell and Strong 1955).

Table 4. Crude protein value. (Jones 1954)

	Dec.	Jan.	Feb.	Mar.	Apr.
Blackbrush	6.1	6.5	5.6	5.6	8.7
Bitterbrush	8.6	8.0	8.7	7.8	13.2
Big sagebrush	10.1	11.2	12.5	14.1	21.8
Buckwheat	6.7	6.1	6.1	7.2	17.8

At present the Buttermilk winter range is in unsatisfactory condition and generally is becoming worse. Key browse species, antelope bitterbrush and big sagebrush, are heavily hedged. The majority of bitterbrush is old and decadent and natural reproduction of bitterbrush has not been sufficient to yield a net increase in forage capacity (T. Blankenship, pers. com. 1982). Blackbrush dominated sites where deer congregate may provide inadequate nutrition and impede bitterbrush regeneration.

BLACKBRUSH WILDFIRES

To determine the potential for introducing fire into blackbrush dominated habitat to improve deer habitat, the effects of wildfires in the Owens Valley were reviewed. Approximately 685 ha (1690 ac) of blackbrush have been burned by three wildfires in the Owens Valley. The Symmes Creek Burn, a relatively hot fire occurring in Spring 1977, was the most recent of these fires. The total perennial cover was reduced to virtually nothing by that fire. After one year, the site was dominated by annual forbs, filaree and foxtail chess. In addition, some desert bitterbrush plants had resprouted. Blackbrush was destroyed and the site six years later is dominated by California buckwheat (Eriogonum fasiculatum) and desert needlegrass (Stipa speciosa), with a variety of other desert shrub seedlings.

Another wildfire, the Oak Creek Burn, is approximately 30 years old. It turned an almost monotypic stand of even-aged blackbrush into a diverse community. The fire decreased blackbrush to 31 percent plant cover. This was accompanied by an increase in desert needlegrass (0 to 14%), Nevada ephedra (5 to 11%), and round-leafed rabbitbrush (Chrysothamnus teretifolius) (8 to 33%). Goldenbush (Haplopappus cooperi) and big sagebrush also are now present.

The Independence wildfire is an example of another blackbrush burn that resulted in a more diverse community after burning. Greater amounts of California buckwheat, wild lilac (Ceanothus greggii), and desert needlegrass increased livestock carrying capacities from 36 acres/AUM to 11 acres/AUM.

Fires have generally increased plant species diversity, livestock carrying capacities, and condition classes on most blackbrush sites in the Owens Valley (Table 5). Desert needlegrass and California buckwheat are common constituents on burned sites. Re-establishment of desert bitterbrush on burns was common due to its sprouting capability, although fire intensity and soil texture may ultimately determine their survival. Re-establishment of antelope bitterbrush has been low, perhaps because of the species need for above annual precipitation. Invasion of undesirable annuals, such as Russian thistle (Salsola kali) and halogeton (Halogeton glomeralus) did not occur.

THE BLACKBRUSH BURN PLAN

Based on these findings, a project was planned to determine the effectiveness of burning to improve the Buttermilk deer winter range. Two 4-hectare plots were selected for prescribed burning in the fall of 1982. These burns were to help determine the most desirable prescription and season for burning blackbrush.

Table 5. Wildfire history of blackbrush range in Owens Valley.

Name of Burn	Year	hectares	Current Vegetative Composition[2]	Carrying Capacity[1] and condition class Preburn Acres/AUM	Postburn condition class	Soils	Average Annual Precipitation
Oak Creek	unk.	81	Cora-Chte-Stsp-Epne	350 Poor	37 Fair	Loamy, 35%+ gravel, cobbles and stones	5"
Independence	unk.	81	Artr-Epne-Erfa	350 Poor	21 Good	Sandy, 35%+ gravel, cobbles and stones	5"
Symmes Creek	unk.	101	Erfa-Stsp	88 Poor	15 Poor	Loamy, 35%+ gravel, cobbles and stones	5"
Symmes Creek 2	unk.	122	Erfa-Stsp	350 Poor	25 Poor	Sandy, 35%+ gravel, cobbles and stones	5"
Symmes Creek 3	pre-1947	260	Erfa-Stsp	88 Poor	11 Poor	Sandy, 35%+ gravel, cobbles and stones	5"

1 Acres/AUM

2 Cora - Blackbrush
Chte - Rabbitbrush
Stsp - Needle-and-thread
Epne - Morman Tea
Artr - Big sagebrush
Erfa - Buckwheat

The following preliminary prescription was selected:

Relative humidity	10-25%
Night time humidity recovery	25-40%
Wind speed	8-20 MPH
Air temperature	60-85 degrees F
Fuel moisture	3-10%
Season	FALL

These parameters took into account the lack of fine fuels in pure stands of decandent blackbrush and the gentle slope (7%) of the sites.

Vegetative composition and density were measured on four paired plots, established to monitor conditions before and after burning. The prescribed burn was conducted in late fall using drip torches, burning a backfire pattern. Fifty foot blacklines and existing roads were used to control the fire. Table 6 summarizes the actual burn characteristics.

Two burned areas of 2000 m^2 (21,500 ft^2) each are now being fenced as study exclosures. Grasses, forbs and shrub species will be seeded in these "nursery plots" to determine the predictability of using fire to convert blackbrush types and to determine the prescription and season for the most desirable results in burning blackbrush.

Table 6. Fire behavior based on weather and fuel conditions.

	Actual	Predicted based on the prescription
Rate of spread (Ch/Hr)	3 - 8	32 - 55
Fireline intensity (Btu/Ft/Sec)	22 - 65	236 -400
Byrams flame length (Ft)	2 - 3	6 - 7
Perimeter (Ch/Hr)	12 - 32	105 -162
Area (Acres Hr)	1 - 8	77 -168
Scorch height (Ft)	7 - 14	19 - 21
Ignition component (Pct)	13 - 22	32 - 42
Heat/unit area (Btu/Sq ft)	441	397

CONCLUSIONS

Blackbrush habitats are relatively poorly studied desert shrub communities of marginal value to livestock and deer. Fire can increase plant species and livestock carrying capacity if the site potential (adequate soils and precipitation) exists.

Successional patterns after burning are generally dependent upon the characteristics of the site and plant species. Desert bitterbrush re-establishes itself after burning, while antelope bitterbrush is slow in returning to the site naturally. Blackbrush is not tolerant to fire and usually does not readily recover.

There is potential to increase deer habitat through prescribed burning and re-seeding of certain blackbrush sites. More research must be completed to understand the ecology of blackbrush and successional patterns following fire before adequate management and large-scale improvements can be made.

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